Claim Rejections

Claims 1 and 10-12 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent 6,428,920 (Badding).

Claim 1 specifies " non-porous body having one side with a relatively smooth surface and another side with a more textured surface with multiple indentations therein, wherein the thickest part of said non-porous body is at least 0.5 micrometers greater than the thinnest part of said electrolyte sheet" and wherein "one side of said electrolyte sheet experiencing a predominately compressive force, the other side of said electrolyte sheet experiencing a predominately tensile force, wherein the side with a relatively smooth surface is subjected to the predominately tensile force and more textured surface subjected to predominately compressive force".

That is, Applicants claimed a non-porous electrolyte body with one relatively smooth surface and one more textured surface. This non-porous electrolyte body has thickness variation of at least 0.5 micrometers.

However, the Badding reference discloses an electrolyte sheet with a non-porous body (layer 4) that has no variation in thickness. This non-porous body is coated with a roughened layer (layer 2) that has a thickness variation, but layer 2 is porous. (See Figure 2 of this reference.) The Examiner referred applicants to page 5, lines 44-47 of this reference. However, page 5, lines 44-47 only states that a variety of printing methods can be used to cover the dense electrolyte substrate (i.e., it is layer 4 that is dense, not layer 2), see also col 5, lns 26-30. Thus, page 5, lns. 44-47 of the cited reference does not teach substituting a non-porous layer 2 for the porous layer 2, as asserted by the Examiner, nor does it teach that the textured layer is non-porous. Similarly, page 6, lns. 24-26, also referenced by the Examiner, discusses dense or porous electrode layers (i.e., anodes and cathodes, layers 6 and 7), and does not mention the electrolyte body.

Although the density of the interface layer (layer 2) may vary, the Badding reference ('920) itself does not teach or suggest that this layer is non-porous. In fact, column 5 (lns. 1-5) of this reference teaches about infiltration of the interfacial layer, which clearly suggests that this layer porous.

Finally, page 7, lines 11-13 of the Badding reference do not disclose a which side of the electrolyte body (i.e the smother side or the less smooth side) faces air and which side faces the fuel. Badding also does not discuss or teach that "one side of said electrolyte sheet experiencing a predominately compressive force, the other side of said electrolyte sheet experiencing a predominately tensile force", as called by applicant's claim 1. Moreover, column 7 (lns. 11-13) of the Badding reference merely states "it is believed that the rough and/or porous nature of the interface allows more contact points for...electrodes to be bound to and to inject oxygen ions into the electrolyte." Thus Badding does not disclose all of the claim elements called for in claim 1.

Finally, the Examiner stated "as pointed out in applicant's specification, it is known to have a higher flow of air across the cathode, creating greater compressive force on the high pressure side (air side) and greater tensile force on the fuel side. So it is inherent that the fuel cell, taught by Badding, has a predominately compressive force on the air side and tensile force on the fuel side."

Applicants respectfully disagree with this assertion. Firstly, applicants did not teach or suggest that this was prior art. Secondly, **this feature is not inherent to any fuel cell configuration, but depends on the size and geometry of the fuel and air chambers**. (For example, the second Badding reference (2001/0044043), described below, does not exibit greater tensile force on the fuel side.) It was Applicants who realised, and taught, in the present application, that this problem may be present in certain configurations, and taught a solution to this problem.

Paragraph [00104] of the present application, when describing the example six of present invention, (which falls under the topic of "DETAILED DESCRIPTIN OF THE PREFERED EMBODIMENTS" states that a fuel cell "will be typically operated with much higher flow of gas (air or oxygen) compared to fuel flow". However, the difference in flow rates does not automatically translates to the difference in pressures or to which side of electrolyte experiences the compressive or the tensile force, because the amount of pressure on the electrolyte depends on chamber size and geometry. Thus Applicants, in paragraph [1004] (see line 3 of this paragraph) expressly mention the air side as an example of the side that experiences a "predominately compressive force on the high pressure side".

It was applicants that recognised that when there "if the electrolyte sheet has one textured and one relatively smooth surface (a feature not taught by the cited reference), it is preferable for the electrolyte sheet to be oriented in a manner such that the textured surface experiences predominately compressive forces". (See paragraph [00104]). It is Applicant's teaching, and the use of hindsight based on Applicant's own teaching is impermissible when evaluating either novelty or the obviousness of the Applicant's invention.

Accordingly, Claims 1 and 10-12 are not anticipated by US Patent 6,428,920 (Badding).

Claims 1 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2001/0044043 (Badding) and evidenced by US Patent 4,874,678 (Reichner).

"The examiner stated that "it is inherent that the fuel cell, taught by Badding, has a predominately compressive force on the air side and tensile force on the fuel side." This feature is not inherent in fuel cell devices. In fact, the Badding reference (2001/0044043) discloses configuration that does not display this feature. Paragraphs [0062] and [0063] of this sited reference disclose that the fuel reservoir utilises a

"restrictor". This restrictor restricts fuel exhaust from leaving the chamber, thus resulting in pressure build-up (more pressure) on the fuel (i.e., anode) side.

As described above, this feature is not inherent to any fuel cell configuration, but depends on the size and configuration of the fuel and air chambers. It was Applicants who realised, and taught, in the present application, that in certain configurations the fuel cell device may have a predominately compressive force on the air side and tensile force on the fuel side, and then taught a solution to this problem. That is, it was applicants that suggested "if the electrolyte sheet has one textured and one relatively smooth surface, it is preferable for the electrolyte sheet to be oriented in a manner such that the textured surface experiences predominately compressive forces". (See paragraph [00104]).

Finally, applicants called for the electrolyte having a non-porous body. None of the cited references show a non-porous electrolyte body that includes at least one textured surface. However, yttria stabilized zirconia can be formed into porous as well as non porous bodies, as evidenced from Figure 2 (see layers 4 and 2) of Patent 6,428,920 (1st Badding reference) and neither Badding, nor any of the other cited references suggest the use of a non-porous body that has a textured surface. Thus, absent the teaching or suggestion, in the cited references themselves, that it is the non porous body that the textured surface, applicant's invention is unobvious over the cited art.

Applicant's claim 11 calls for the electrolyte thickness of 4 to 15 micrometers. The McElroy reference teaches an electrolyte with a thickness of 50 μm or more, not 4 to 15 μm. (See paragraph [0187] of McElroy, which teaches that the textured surface is 5% or less, and preferably 1% or less of the average electrolyte thickness.) It is noted that 1% of 50 μm is 0.5 μm and 5% of 50μm is 2.5 μm, which is suggested surface roughness rage of paragraph 0187. Paragraph [0195] of this reference discloses a substrate layer of 50μm to 200 μm. Finally, [0205] of this reference suggests that an abrasive powder with the particle size of 5 to 45 μm can be used to create the textured

surface. However, such large abrasive particles could not be used with a very thin electrolyte, such as one claimed in claim 11, because the large particles would tear such thin electrolyte, damaging it greatly.

Accordingly, Claims 1 and 10-12 are not unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2001/0044043 (Badding) and evidenced by US Patent 4,874,678 (Reichner).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over McElroy, Badding and Reichner as applied to claim 1 above, and further in view of US Patent 6,045,935 (Ketcham).

Contrary to the Examiner's assertion, the Ketcham reference does not teach that the electrolyte is thicker in the middle and thinner at the edges. Altough the disclosed electrolyte sheet is bent, but its thickness is constant. The Ketcham reference does not teach, disclose or suggest that the electrolyte is thicker in the middle and thinner at the edges. Accordingly, Claim 3 is not unpatentable over McElroy, Badding and Reichner as applied to claim 1 above, and further in view of US Patent 6,045,935 (Ketcham).

Response to the Section 6 (pg. 7) of the Office Action

In response to Applicant's previous arguments the Examiner stated "Applicant argues that the electrolyte of Badding is not a substantiall non-porous body. As discussed above, the electrolyte substrate is a dense yttria stabilised zirconia, which is substantially non-porous".

Applicants respectfully submit that the <u>interfacial layer (textured) of the first Budding reference is porous</u>. And that the non-porous electrolyte layer of this reference does not have a textured surface as claimed by the applicant. Instead, the cited reference utilised three different layers- two <u>porous, roughned layers</u> and a <u>smooth non porous substrate</u>

body, sandwiched between these porous, roughned layers (See Fig. 2 of Badding and the 3rd paragraph in col. 4).

Conclusion

Based upon the above amendments, remarks, and papers of records, applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Applicant believes that no extension of time is necessary to make this Reply timely. Should applicant be in error, applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Svetlana Z. Short at 607-974-0412.

Respectfully submitted,

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